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ISSUE BRIEF

Enhancing US-Japan Cooperation on Global Supply Chains

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MIYEON OH,
JAMES HILDEBRAND,
HARRY WS LEE

INTRODUCTION

Mounting US-China tensions and the COVID-19 pandemic have led to growing calls in the United States and among its allies and partners, including Japan, to address the vulnerabilities in global supply chains critical to national security and economic competitiveness. Strategic uncertainty has led stakeholders to pose the following questions. What role should government play, and to what extent can, or should, governments require firms to operate more in line with national security interests? How can firms manage short-term and long-term risks to balance national security requirements and commercial interests?[1] How should trusted partners be defined, and what is a desirable allied and multilateral approach to enhancing security and resilience of global high-tech supply chains? With new administrations in both the United States and Japan, the two countries have an opportunity to consider these questions and rethink coordination of their efforts to establish secure and resilient supply chains.

This issue brief analyzes recent developments in US and Japanese supply-chain policy, explores the importance of closer coordination through case studies of the semiconductor and rare-earth minerals industries, and provides a set of recommendations for the Joseph R. Biden Jr. and Yoshihide Suga administrations to enhance US-Japan cooperation in the years ahead. These recommendations include actions to operationalize the April 2021 US-Japan Joint Leaders' Statement by creating a bilateral interagency Supply Chain Steering Committee that includes sector-specific working groups to enhance public-private-partnerships in high-technology industries, and by expanding bilateral supply-chain cooperation into multilateral efforts through flexible and informal frameworks.

1 Robert Dohner, Trey Herr, and Miyeon Oh, *Global Value Chains in an Era of Strategic Uncertainty: Prospects for US-ROK Cooperation, Atlantic Council*, 2020, https://www.atlanticcouncil.org/in-depth-research-reports/report/global-value-chains-in-an-era-of-strategic-uncertainty-prospects-for-us-rok-cooperation/.

BIDEN'S EMERGING SUPPLY-CHAIN POLICY—TARGETED DECOUPLING?

Since President Biden took office, his actions have indicated that securing US supply chains to address vulnerabilities, protect national security, and promote domestic manufacturing will be among his administration's top economic priorities, as it was for the Donald Trump administration. However, Biden's early actions suggest his administration will seek to take a more targeted and coordinated approach to its supply-chain policy than that of the previous administration. This approach entails targeting supply chains for specific critical goods or technologies for diversification away from dependence on China—what could be called a kind of "targeted decoupling" from the Chinese economy. Biden's emerging supply-chain policy also appears to prioritize large amounts of federal funding to help develop critical supply chains within the United States. More importantly, when compared to the Trump administration, the Biden administration has placed greater emphasis on cooperating with allies and partners under both bilateral and multilateral frameworks to address supply-chain issues.

Early Actions

In the first one hundred days of his presidency, Biden has taken a series of initial actions that are directly or indirectly relevant to supply chains, including announcing executive orders (EOs) to review policies, making proposals for investment bills, expanding existing export regimes, and holding discussions with allies and partners.

- On January 21, Biden issued an Executive Order on a Sustainable Public Health Supply Chain, which orders, among several other actions, the delivery of a "pandemic supply chain resilience strategy" from the secretaries of defense, health and human services, and homeland security, in coordination with the national security advisor and other relevant parties, within one hundred and eighty days.[2]

- On January 25, Biden issued an Executive Order on Ensuring the Future is Made in all of America by All of America's Workers. The executive order, which strengthens "Buy American" laws favoring domestic businesses in competition for federal procurement, is seen as important for attracting and retaining investment in critical goods and materials, and as a companion to efforts to secure supply chains.[3]

- On January 27, Biden refined a ban Trump imposed on trading securities of Chinese military companies by granting a license through the Treasury Department's Office of Foreign Assets Control (OFAC) for trading securities of entities that have similar names but are not the targeted companies. While it seems like a relaxation of restrictions on the surface, the measure was intended to more clearly delineate the scope of Trump's ban in order to make compliance and enforcement more effective.[4]

- On February 10, Biden announced the formation of a Department of Defense China Task Force, which is reviewing US defense-industry supply chains and continuing work begun in the Trump administration on supply chains related to critical technology and hardware used in US defense systems.[5]

- On February 24, Biden issued an Executive Order on America's Supply Chains that calls for two sets of supply-chain reviews.

    - The executive order requires review and report of particular high-risk supply chains, with recommendations to be completed within one hundred days by the secretaries of commerce, energy, defense, and health and human services.[6] These include: semiconductor manufacturing and advanced packaging; high-capacity batteries; critical minerals, including rare-earth elements; and pharmaceuticals and active pharmaceutical ingredients.

    - It also requires federal agencies to conduct reviews and provide reports within one year, providing assessments of vulnerabilities and recommendations to ensure resilience and reduce reliance on foreign competitors for other key supply chains. These sectors include the defense industrial base (by the

2 Exec. Order No. 14001, 3 C.F.R. (2021), https://www.govinfo.gov/content/pkg/DCPD-202100074/pdf/DCPD-202100074.pdf.

3 Exec. Order No. 14005, 3 C.F.R. (2021), https://www.govinfo.gov/content/pkg/DCPD-202100085/pdf/DCPD-202100085.pdf.

4 "Executive Order 13959 of November 12, 2020: Addressing the Threat From Securities Investments That Finance Communist Chinese Military Companies, as Amended," Department of the Treasury, Office of Foreign Assets Control, 2021, https://home.treasury.gov/system/files/126/ccmc_gl1a_01272021_1.pdf.

5 Paul McLeary, "China Supply Chain, Backdoor Money 'Huge Priority' For Biden Pentagon," *Breaking Defense*, February 11, 2021, https://breakingdefense.com/2021/02/china-supply-chain-backdoor-money-huge-priority-for-biden-pentagon/.

6 Exec. Order No. 14017, 3 C.F.R. (2021), https://www.govinfo.gov/content/pkg/DCPD-202100163/pdf/DCPD-202100163.pdf.

secretary of defense); public-health and biological-preparedness industrial base (by the secretary of health and human services); information and communications technology (ICT) (by the secretaries of commerce and homeland security); energy-sector industrial base (by the secretary of energy); transportation industrial base (by the secretary of transportation); and agricultural commodities and food products (by the secretary of agriculture).[7]

- On March 12, Biden met with the leaders of the Quadrilateral Security Dialogue (Quad) and agreed to "launch a critical—and emerging—technology working group to facilitate cooperation on international standards and innovative technologies of the future."[8]
- On March 31, Biden announced a $2-trillion infrastructure package, a large portion of which is earmarked to help develop supply chains for clean-energy sectors, including electric vehicles (EV), EV batteries, EV charging stations, electric grids, and research and development (R&D) in clean-energy technologies.[9]
- On April 8, the Department of Commerce added seven Chinese tech companies and state labs to its Entity List for using or building supercomputers involved in the development of advanced weapons, such as hypersonic missiles, banning them from buying US-origin technology.[10]
- On April 16, President Biden met Japanese Prime Minister Yoshihide Suga in Washington, DC. The joint statement that came out of this meeting specifically called out "sensitive supply chains, including on semiconductors" as a key target for US-Japan cooperation.[11]

Continuities and Departures in Biden's Emerging Approach

There are several emerging themes in the Biden administration's early rhetoric and actions that represent both continuity and departure from the Trump administration's approach to supply chains.

This issue brief focuses on the following two points of apparent continuity. First, Biden's early actions indicate that securing US supply chains to address vulnerabilities, protect national security, and promote domestic manufacturing will be among his administration's top economic priorities, as they were during the Trump administration. Like Trump, Biden appears to view supply-chain policy as a tool that can also be used to provide economic benefits to US workers and create jobs through onshoring and reshoring. Also, like Trump, Biden views China as a country whose role in supply chains for critical products poses national security threats and urges that no US ally should be dependent on critical supplies from countries like China.[12] Biden also links supply-chain issues with China to broader concerns about Chinese unfair trading practices that put US companies at a "steep disadvantage" when purchasing raw materials.[13] Overall, this continuity is not surprising, particularly in light of comments from Xi Jinping on supply chains. Xi stated at the seventh meeting of the Central Financial and Economic Affairs Commission in April 2020 that "we must tighten international production chains' dependence on China, forming powerful countermeasures and deterrent capabilities based on artificially cutting off supply to foreigners."[14]

7 Ibid.

8 It remains unclear whether issues pertaining to global supply chains were discussed during the "two-plus-two" meetings with South Korea (ROK) and Japan in March or the US-Japan-ROK Trilateral National Security Advisors' meeting in April. While *Nikkei Asia* reported that cooperation on rare earths was expected to be the agenda of the Quadrilateral Security Dialogue in March, the White House press statement did not specifically mention rare-earth metals; "Quad Leaders' Joint Statement: 'The Spirit of the Quad,'" White House, March 12, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/12/quad-leaders-joint-statement-the-spirit-of-the-quad/; "Quad Tightens Rare-Earth Cooperation to Counter China," Nikkei Asia, March 11, 2021, https://asia.nikkei.com/Politics/International-relations/Indo-Pacific/Quad-tightens-rare-earth-cooperation-to-counter-China#:~:text=According%20to%20data%20from%20the,the%20biggest%20rare%2Dearth%20consumers.

9 Myles McCormick, "Biden Throws Weight of US Government Behind Clean Energy," *Financial Times,* April 3, 2021, https://www.ft.com/content/33bcf3fc-bc44-4fe0-b1ff-4ec2dbb4168d.

10 Ellen Nakashima, "Biden Administration Slaps Export Controls on Chinese Firms for Aiding PLA Weapons Development," *Washington Post*, April 8, 2021, https://www.washingtonpost.com/national-security/biden-administration-slaps-export-controls-on-chinese-firms-for-aiding-pla-weapons-development/2021/04/07/0c45bf0a-97f6-11eb-b28d-bfa7bb5cb2a5_story.html.

11 Naoatsu Aoyama, "Semiconductor Shortage on the Agenda when Biden, Suga Meet," *Asahi Shimbun*, April 9, 2021, http://www.asahi.com/ajw/articles/14327669.

12 "The Biden Plan to Rebuild US Supply Chains and Ensure the US Does Not Face Future Shortages of Critical Equipment," Biden Harris Democrats, https://joebiden.com/supplychains/.

13 Ibid.

14 Xi Jinping, "Certain Major Issues for Our National Medium- to Long-Term Economic and Social Development Strategy," trans. Etcetera Language Group, Inc., Georgetown University Center for Security and Emerging Technology, November 10, 2020, https://cset.georgetown.edu/wp-content/uploads/t0235_Qiushi_Xi_economy_EN.pdf.

Second, there is a large degree of continuity in the Biden administration's dual approach toward maintaining the US lead in advanced and emerging technologies critical to competition with China: one approach involves slowing or preventing China's technological development, and the other involves boosting the United States' own domestic capabilities by onshoring and reshoring. For now, Biden appears willing to continue to implement Trump's measures targeting China with export controls and sanctions, and he has taken some early steps such as adding more Chinese companies to the Entity List and providing more information on banned entities to induce better compliance. Still, it remains to be seen how far the Biden administration will go in terms of continuing, expanding, or enhancing these measures in the long term.

At the same time, on the following points, there appears to be some degree of departure. Biden, like Trump, appears to be interested in onshoring supply chains through foreign direct investment. However, Biden seems to be prioritizing proposals that include injecting large amounts of federal funding in order to help develop critical supply chains in the United States. For instance, Biden's American Jobs Plan specifically called for an investment of $50 billion from Congress "to create a new office at the Department of Commerce dedicated to monitoring domestic industrial capacity and funding investments to support production of critical goods," and a further $50 billion in semiconductor manufacturing and R&D in response to language from the Creating Helpful Incentives to Produce Semiconductors for America Act (CHIPS for America Act).[15] Additionally, Biden seems to be seeking a more targeted, coordinated approach toward formulating a strategy for supply chains. His Executive Order on America's Supply Chains identified a limited number of priority supply chains, including semiconductors, EV batteries, and critical minerals, such as rare earths, to focus on as part of a one-hundred-day review. The current approach, focusing on a set of key priority areas, points to a kind of "targeted decoupling" from China that seeks to reduce dependence across a set of key strategic supply chains while leaving room for other commercial activity. The Biden administration also seems to be aiming for a well-coordinated cross-government effort, with year-long reviews conducted by the secretaries of commerce, energy, defense, homeland security, transportation, and health and human services. Finally, the Biden administration has strongly emphasized the need to coordinate efforts with US allies and partners, under both bilateral and multilateral frameworks. After announcing the need for "close cooperation on resilient supply chains with allies and partners" in his Executive Order on America's Supply Chains in February, Biden followed up with agreements among the Quad leaders and with Suga in a separate bilateral meeting to cooperate on critical tech sectors and supply chains.[16] Although the Trump administration did attempt to cooperate with allies and partners through initiatives such as the Economic Prosperity Network, it made little progress toward operationalizing multilateral allied efforts on supply chains.[17] More generally, US relations with allies and partners under Trump were fraught with disputes over defense cost sharing and trade arrangements that lasted throughout his administration.

JAPAN'S SUPPLY-CHAIN POLICY FROM ABE TO SUGA—SEEKING RESILIENCE WITHOUT DECOUPLING

Under Prime Minister Shinzo Abe, and now under Prime Minister Suga, Japan has been an early mover in establishing a proactive supply-chain policy. In March 2020, Abe presided over a meeting of the Council on Investments for the Future, convening Japanese business leaders and declaring the need to relocate Japan's "high-added-value" manufacturing bases in China back to Japan and to diversify them to countries in Southeast Asia.[18] On April 7, 2020, the Abe government rolled out an emergency economic package, which included an allocation of 220 billion yen toward relocating production back to Japan and 23.5 billion yen to diversify supply chains to Southeast Asia.[19] Japan's Ministry of Economy, Trade, and Industry (METI) identified five industries as the focus of the

15 "Fact Sheet: The American Jobs Plan," White House, March 31, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/.

16 Exec. Order No. 14017, 3 C.F.R. (2021), https://www.govinfo.gov/content/pkg/DCPD-202100163/pdf/DCPD-202100163.pdf.

17 The EPN, "comprised of like-minded countries, companies, institutions, and civil society that operate under a set of trust principles for areas of all economic collaboration," had three goals: "the first [was] ensuring sustained economic growth and prosperity for all partners; the second [was] expanding fair, transparent, and reciprocal collaboration and trust principles to all aspects of economic partnering; and the third [was] creating a level playing field for companies, economies, and countries, based on integrity, reciprocity, accountability, transparency, and fairness." "Under Secretary Keith Krach Briefs the Press on Huawei and Clean Telcos," US Department of State, June 25, 2020, https://2017-2021.state.gov/telephonic-briefing-with-keith-krach-under-secretary-for-economic-growth-energy-and-the-environment/index.html; "Trump Administration Pushing to Rip Global Supply Chains from China: Officials," Reuters, May 4, 2020, https://www.reuters.com/article/us-health-coronavirus-usa-china/trump-administration-pushing-to-rip-global-supply-chains-from-china-officials-idUSKBN22G0BZ.

18 "Council on Investments for the Future," Cabinet Office, Government of Japan, March 5, 2020, https://japan.kantei.go.jp/98_abe/actions/202003/_00009.html.

19 "Fiscal Year Reiwa 2 Supplementary Budget Overview (PR Materials)," Ministry of Economy, Trade, and Industry, April 2021, 24–25, https://www.meti.go.jp/main/yosan/yosan_fy2020/hosei/pdf/hosei_yosan_pr.pdf; Scott B. MacDonald, "The New Cold War, Japan and Its Chinese Supply Chains," *National Interest*, May 31, 2020, https://nationalinterest.org/feature/new-cold-war-japan-and-its-chinese-supply-chains-158756.

government's efforts to diversify value chains: rare-earth metals, automobiles, electronics, medical devices/machinery, and hygiene products—a list with significant overlap with priority sectors identified by the Biden administration.[20] Following this announcement, Tokyo offered several rounds of subsidies to encourage firms to relocate production back to Japan or diversify supply chains by moving to a third country, mostly in Southeast Asia.[21] Measures to reshore Japanese firms have also been paired with efforts to attract foreign direct investment in advanced semiconductor manufacturing. The Taiwanese semiconductor firm TSMC recently announced plans to build a $171-million semiconductor R&D facility in Japan.[22] Finally, regarding the rare-earth and other important metal supply chains, the Suga administration has reportedly been working to revamp strategic stockpile programs, loosen regulations that restrict government funding for natural-resource exploration, and pursue multilateral cooperation on strategic investments with Washington and Canberra.[23]

A Less Confrontational Approach to China

The Japanese government has been concerned about the concentration of its supply chains in China since at least 2010, when a dispute with China over the Senkaku Islands in the East China Sea resulted in Beijing's unofficial ban of rare-earth exports to Japan.[24] While the Japanese government has rolled out "China plus one" subsidies in an effort to reduce dependence on China since 2010, no significant relocations took place until 2020, when factories across China were shut down due to the onset of the COVID-19 pandemic, dramatically disrupting some of Japan's supply chains.[25] Unlike US rhetoric surrounding the importance of supply-chain security to address risks associated with China, the Japanese government has emphasized the need for diversification and resilience in a broader context. Regarding the subsidies released in 2020, Japanese government officials maintain that the measures are by no means intended to "decouple" Japan from China, but merely to diversify strategically critical supply chains, while maintaining significant commercial activity in China.[26] "We are not retreating from globalization, but we have to update globalization," an anonymous METI official told the Washington Post in July 2020.[27] Another Japanese government source told the Economist that the focus is to address "several strategic choke-points" while "keeping many areas open for commercial activity."[28]

Subsidy Offers

The Japanese government has offered billions of dollars in subsidies to promote supply-chain diversification and onshore manufacturing. Over the past year, METI offered two rounds of subsidies totaling around $2.8 billion to

20 "Fiscal Year Reiwa 2 Supplementary Budget Overview (PR Materials)."

21 Three hundred and six billion yen (approx. $2.95 billion) according to METI. A press release from METI calls the July subsidy a "supply chain measure to promote domestic investment and production." See: "Preliminary Recipients of Domestic Investment Promotion Project Subsidies for Supply Chain Measures Have Been Decided," Ministry of Economy, Trade, and Industry, July 17, 2020, https://www.meti.go.jp/press/2020/07/20200717005/20200717005.html; "Change to Adoption Schedule of Domestic Investment Promotion Subsidies for Supply Chain Measures," Ministry of Economy, Trade, and Industry, October 21, 2020, https://www.meti.go.jp/press/2020/10/20201021004/20201021004.html; "Subsidies for Production Transfer from China, India and Bangladesh Added," *Nikkei*, September 3, 2020, https://www.nikkei.com/article/DGXMZO63406020T00C20A9EE8000.

22 Reportedly, the Japanese government has tried to attract TSMC to invest in a factory focused on upstream production processes in Japan. The R&D facility has attracted positive industry attention, but, as *Nikkei*'s Junichi Sugihara notes, it is a much smaller investment than TSMC's plant in Arizona. Currently, it is not clear if TSMC will receive a subsidy for the construction of the R&D facility. Junichi Sugihara, "Japan Seeks Shot in the Arm from TSMC to Revive Chipmaking Sector," *Nikkei Asia*, March 21, 2021, https://asia.nikkei.com/Business/Tech/Semiconductors/Japan-seeks-shot-in-the-arm-from-TSMC-to-revive-chipmaking-sector.

23 "Japan to Boost Public Funding for Rare Earth Exploration," *Nikkei Asia*, April 21, 2021, https://asia.nikkei.com/Business/Markets/Commodities/Japan-to-boost-public-funding-for-rare-earth-exploration; Ryosuke Hanafusa, "Japan to Pour Investment into Non-China Rare-Earth Projects," *Nikkei Asia*, January 15, 2020, https://asia.nikkei.com/Politics/International-relations/Japan-to-pour-investment-into-non-China-rare-earth-projects; Rieko Suda, "Japan to Strengthen Control over Rare Metal Reserves," *Argus*, July 3, 2020, https://www.argusmedia.com/en/news/2120125-japan-to-strengthen-control-over-rare-metal-reserves#:~:text=Japan%20is%20planning%20to%20ramp,geopolitical%20instability%20or%20future%20pandemics.

24 Keith Bradsher, "China Still Bans Rare Earth to Japan," *New York Times*, November 10, 2010, https://www.nytimes.com/2010/11/11/business/global/11rare.html; Keith Bradsher, "Amid Tension, China Blocks Vital Exports to Japan," New York Times, September 22, 2010, https://www.nytimes.com/2010/09/23/business/global/23rare.html.

25 Naomi Tajitsu, Makiko Yamazaki, and Ritsuko Shimizu, "Japan Wants Manufacturing Back from China, but Breaking up Supply Chains Is Hard to Do," Reuters, June 8, 2020, https://www.reuters.com/article/us-health-coronavirus-japan-production-a/japan-wants-manufacturing-back-from-china-but-breaking-up-supply-chains-is-hard-to-do-idUSKBN23F2ZO.

26 Simon Denyer, "Japan Helps 87 Companies to Break from China after Pandemic Exposed Overreliance," *Washington Post*, July 21, 2020, https://www.washingtonpost.com/world/asia_pacific/japan-helps-87-companies-to-exit-china-after-pandemic-exposed-overreliance/2020/07/21/4889abd2-cb2f-11ea-99b0-8426e26d203b_story.html.

27 Ibid.

28 "Can Japan Inc Navigate the Rift between China and America?" *Economist*, September 3, 2020, https://www.economist.com/business/2020/09/03/can-japan-inc-navigate-the-rift-between-china-and-america.

Figure 1: Companies Receiving METI's "Onshoring" Subsidies

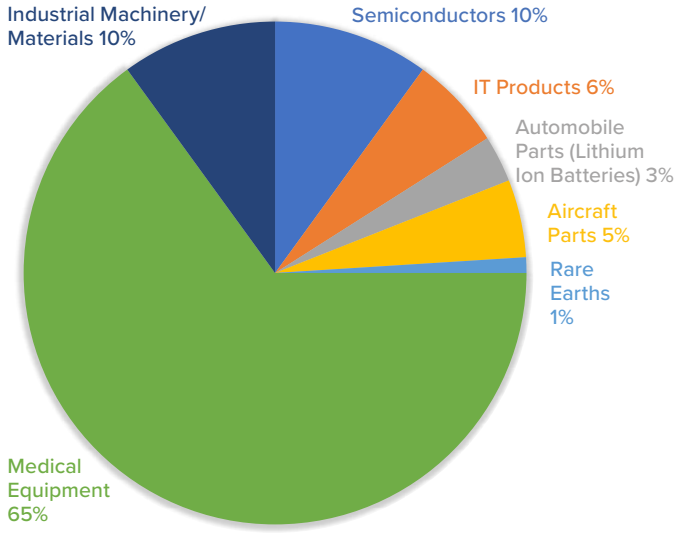


Figure 2: Companies Receiving JETRO's "Offshoring" Subsidies

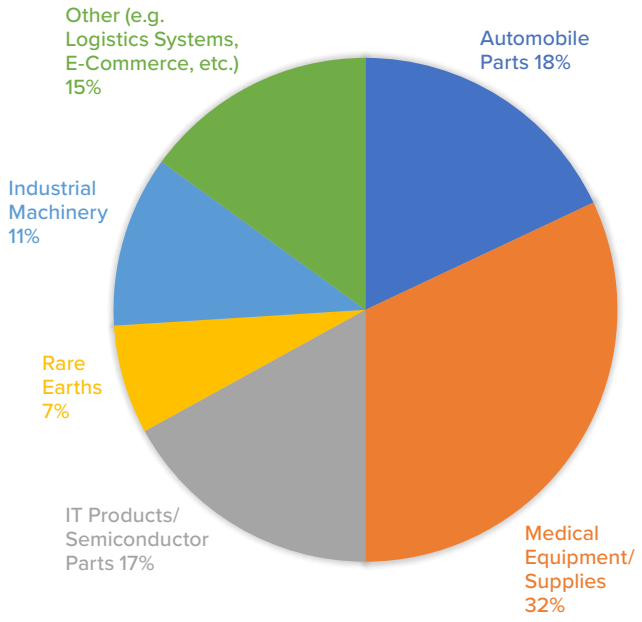
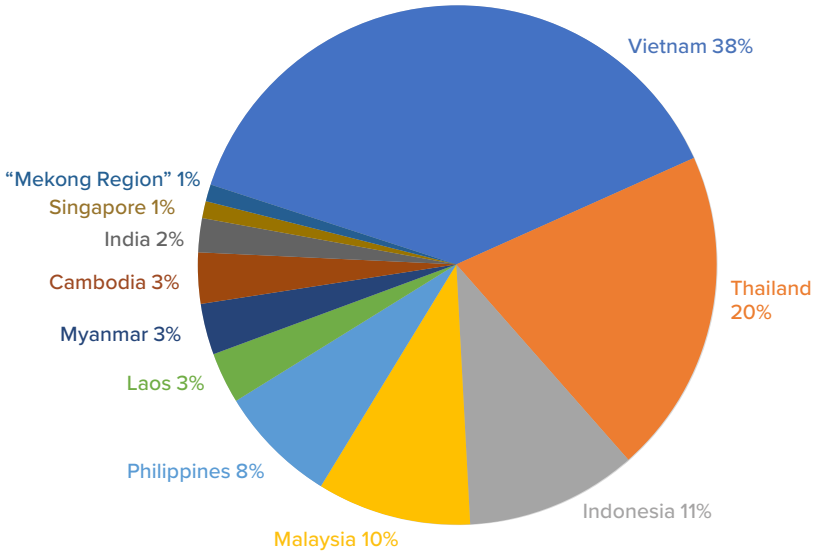


Figure 3: Destinations for Companies Receiving JETRO's "Offshoring" Subsidies



Source: "Domestic Investment Promoting Business Subsidies for Supply Chain Measures," Ministry of Economy, Trade, and Industry, https://www.meti.go.jp/press/2020/11/20201120005/20201120005-1.pdf; "Supporting Business Diversification of Overseas Supply Chains," Japan External Trade Organization, https://www.jetro.go.jp/services/supplychain/.

encourage firms to relocate production back to Japan (onshoring subsidies).[29] According to METI, these subsidies are meant to support onshoring of supply chains that are vulnerable due to their "high degree of concentration" or involve products "essential for people's wellbeing."[30] In July 2020, METI announced that it had selected fifty-seven out of an initial ninety applicants to receive approximately $530 million in funding.[31] In November 2020, it added one hundred and forty-six out of an additional 1,679 applicants to receive a total of approximately $2.3 billion, bringing the overall total to two hundred and three companies.[32] As shown in Figure 1, of the firms receiving onshoring subsidies, medical-equipment companies figured most prominently (65 percent of the total), followed by semiconductor producers (10 percent) and industrial-machinery and materials producers (10 percent).

Meanwhile, the Japanese External Trade Organization (JETRO) has been organizing financial support for companies looking to diversify overseas supply chains to Southeast Asia (offshoring subsidies) under its Program for Strengthening Overseas Supply Chains.[33] A total of eighty-one recipients over three rounds were announced in July, November, and December 2020, with a fourth round opened in March 2021.[34] Among firms receiving offshoring subsidies, as shown in Figure 2, the medical equipment and supplies industry again figured most prominently (36 percent), followed by automobile-part producers (20 percent) and information-technology (IT) products/semiconductor-part producers (19 percent). For those receiving offshoring subsidies, the favored destinations of diversification were Vietnam (38 percent), Thailand (20 percent), Indonesia (11 percent), Malaysia (10 percent), and the Philippines (8 percent).

Japan's economic dependence on China and geographic proximity may be leading Japan to take a less confrontational approach to its relations with China. Bilateral trade totals more than $300 billion and is likely to grow as the Regional Comprehensive Economic Partnership (RCEP) comes into force.[35] Japanese companies maintain significant manufacturing bases in China, and are unlikely to exit the market completely. In 2018, Japanese companies had at least 7,400 affiliates in China that sold $252 billion worth of products: 73 percent in China and 17 percent in Japan.[36] As of 2020, Japanese firms accumulated more than $130 billion in assets in China.[37] In 2019, Japanese foreign direct investment into China was $14.4 billion, the highest ever.[38] Listed Japanese companies derived 26 percent of their profits through suppliers and customers in China, which is higher than their profits made in the United States.[39] In fact, despite offers of government subsidies, no major Japanese semiconductor firms have announced plans to leave China.

29 "Successful Applicants Selected for the Program for Promoting Investment in Japan to Strengthen Supply Chains," Ministry of Economy, Trade and Industry, July 17, 2020, https://www.meti.go.jp/english/press/2020/0717_002.html; "Successful Applicants Selected for the Program for Promoting Investment in Japan to Strengthen Supply Chains," Ministry of Economy, Trade, and Industry, November 20, 2020, https://www.meti.go.jp/english/press/2020/1120_001.html.

30 "Successful Applicants Selected for the Program for Promoting Investment in Japan to Strengthen Supply Chains," July 17, 2020.

31 Ibid.

32 Ibid; "Successful Applicants Selected for the Program for Promoting Investment in Japan to Strengthen Supply Chains," November 20, 2020.

33 "Program for Strengthening Overseas Supply Chains: 1st Invitation," Japan External Trade Organization, 2020, https://www.jetro.go.jp/ext_images/services/supplychain/kekka1_en.pdf; "Program for Strengthening Overseas Supply Chains: 2nd Invitation," Japan External Trade Organization, 2020, https://www.jetro.go.jp/ext_images/services/supplychain/info-2/kekka2_en.pdf; "Program for Strengthening Overseas Supply Chains: 3rd Invitation," Japan External Trade Organization, 2020, https://www.jetro.go.jp/ext_images/services/supplychain/info-3/kekka3_en.pdf; "About the Opening of the Fourth Public Invitation (Facility Introduction Support)," Japan External Trade Organization, March 26, 2021, https://www.jetro.go.jp/services/supplychain/info-4.html.

34 "Preliminary Recipients of Domestic Investment Promotion Project Subsidies for Supply Chain Measures Have Been Decided"; "Schedule Change to Adoption Schedule of Domestic Investment Promotion Subsidies for Supply Chain Measures," Ministry of Economy, Trade, and Industry, October 21, 2020, https://www.meti.go.jp/press/2020/10/20201021004/20201021004.html; "Subsidy for Production Transfer from China; India and Bangladesh Added," Nikkei, September 3, 2020, https://www.nikkei.com/article/DGXMZO63406020T00C20A9EE8000.

35 "Why Has the World's Largest Free Trade Bloc Formed in East Asia," Associated Press, November 27, 2020, https://apnews.com/press-release/pr-newswire/business-government-business-and-finance-global-trade-greater-china-economic-policy-183d465ab834a1ca5895bf5d5a041b96. The Regional Comprehensive Economic Partnership is a free-trade agreement between fifteen Asia-Pacific nations, including China, signed on November 15, 2020.

36 Tajitsu, et al., "Japan Wants Manufacturing Back from China, but Breaking up Supply Chains Is Hard to Do."

37 "Can Japan Inc Navigate the Rift between China and America?"

38 Ibid.

39 Ibid.

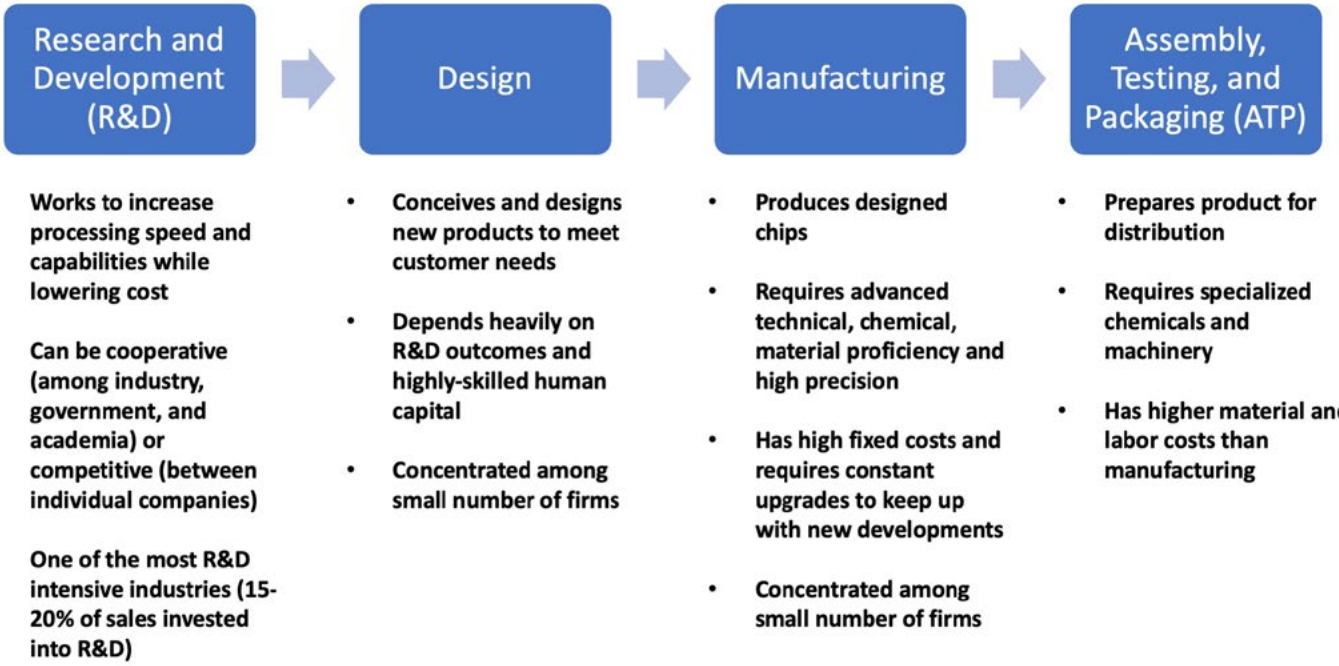
CASE STUDIES

Although they might have taken different approaches to dealing with challenges posed by China, both the United States and Japan aim for diverse and resilient supply chains, particularly for key strategic technologies that are critical to their economic competitiveness and national security. This issue brief examines how these dynamics between national security and economic competitiveness are playing out in two key sectors: semiconductors and rare-earth minerals. These case studies illustrate many of the important factors shaping supply chains in these critical sectors, which may help illuminate how the United States and Japan can pursue future cooperative efforts in both bilateral and multilateral settings.

Case Study 1: Semiconductors

The semiconductor industry is currently at the heart of growing international concerns over China's technological ambitions and supply-chain vulnerabilities. Semiconductors are essential to China's digital development plan, and the Chinese government has articulated a comprehensive national strategy for self-sufficiency across all stages of the semiconductor supply chain.[40] While the United States and Japan—along with several other countries—remain key players in the industry, China's aspirations to global tech leadership, including on semiconductors, make this industry particularly important for enhanced supply-chain cooperation efforts.

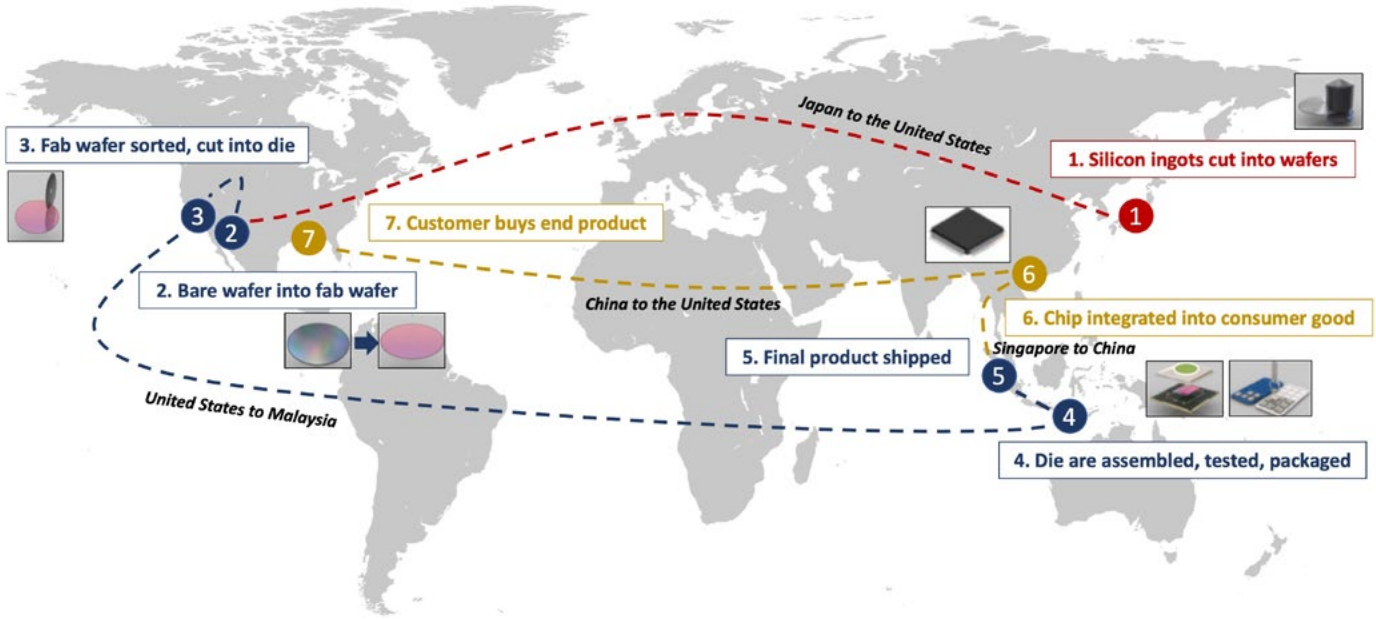
Figure 4: A Simple Representation of the Semiconductor Supply Chain



Source: Adapted from "Beyond Borders: The Global Semiconductor Value Chain," Semiconductor Industry Association and Nathan Associates, May 2016, 10, https://www.semiconductors.org/wp-content/uploads/2018/06/SIA-Beyond-Borders-Report-FINAL-June-7.pdf; Samuel M. Goodman, Dan Kim, and John VerWey, "The South Korea-Japan Trade Dispute in Context: Semiconductor Manufacturing, Chemicals, and Concentrated Supply Chains," US International Trade Commission, October 2019, 2, https://usitc.gov/publications/332/working_papers/the_south_korea-japan_trade_dispute_in_context_semiconductor_manufacturing_chemicals_and_concentrated_supply_chains.pdf.

40 Stephen Ezell, "An Allied Approach to Semiconductor Leadership," Information Technology and Innovation Foundation, 2020, https://itif.org/publications/2020/09/17/allied-approach-semiconductor-leadership.

Figure 5: An Illustrative Example of the Semiconductor Supply Chain



Source: "Beyond Borders: The Global Semiconductor Value Chain."

While China's semiconductor industry is generally regarded as relatively weak, its government is intently focused on rapid development of an independent chip industry.[41] Since designating the semiconductor industry as a strategic sector from at least the early 2000s, China has sought to develop a vertically integrated domestic semiconductor ecosystem from the ground up through various subsidies and tax incentives, as well as acquisition of intellectual property (IP) and know-how from overseas in order to become more self-sufficient.[42] Recent efforts have included:

- publication of Guidelines to Promote National Integrated Circuit Industry Development, "which sets the goals of establishing a world-leading semiconductor industry in all areas of the integrated circuit supply chain by 2030";[43]
- release of the 14th Five-Year Plan for 2021-2025, which called for "significant breakthroughs on core technologies," including semiconductors, through 7-percent annual increases in R&D spending through 2025; and[44]
- creation of several funds to assist domestic firms in achieving the government's goals, including: 1) the $150-billion China Integrated Circuit Investment Industry Fund (CICIF) to support domestic industry

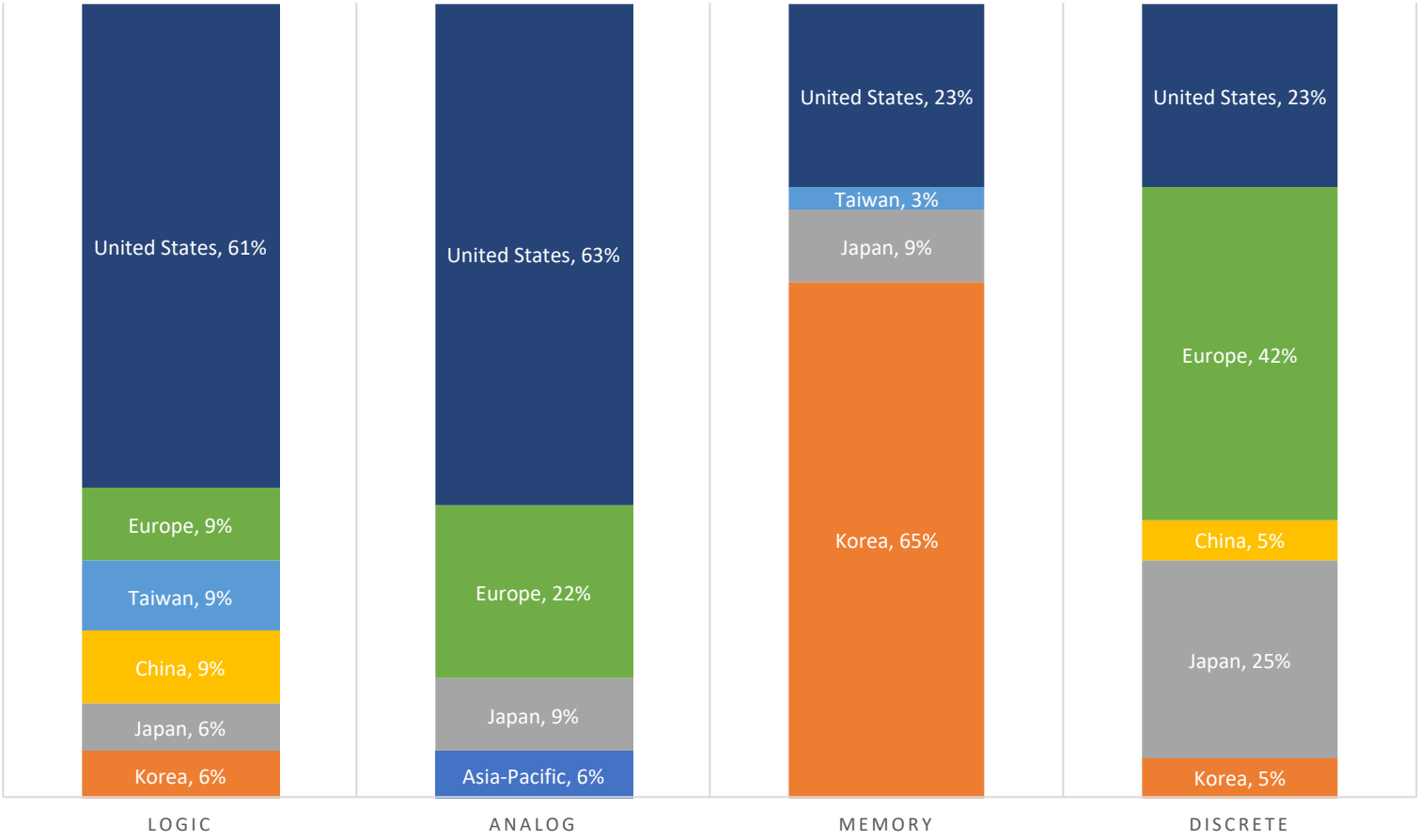
41 Michaela D. Platzer, John F. Sargent Jr., and Karen M. Sutter, "Semiconductors: US Industry, Global Competition, and Federal Policy," Congressional Research Service, October 26, 2020, 27, https://fas.org/sgp/crs/misc/R46581.pdf; Paul Mozur and Steven Lee Myers, "Xi's Gambit: China Plans for a World Without American Technology," *New York Times*, March 10, 2021, https://www.nytimes.com/2021/03/10/business/china-us-tech-rivalry.html; "China to Fall Far Short of Its 'Made-in-China 2025' Goal for IC Devices," *IC Insights*, May 21, 2020, https://www.icinsights.com/news/bulletins/China-To-Fall-Far-Short-Of-Its-MadeinChina-2025-Goal-For-IC-Devices/. Although the Chinese government has invested "tens of billions of dollars" in domestic chip production, it still remains generations behind in most segments, and still imports about 85 percent of its chips supply, with a less than 1-percent increase in reliance on domestic chips since 2014.

42 Platzer, et al., "Semiconductors: US Industry, Global Competition, and Federal Policy," 27; James A. Lewis, "Learning the Superior Techniques of the Barbarians: China's Pursuit of Semiconductor Independence," Center for Strategic and International Studies, 2019, https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/190115_Lewis_Semiconductor_v6.pdf.

43 Platzer, et al., "Semiconductors: US Industry, Global Competition, and Federal Policy."

44 Liza Lin, "China Targets AI, Chips Among Seven Battlefronts in Tech Race With US," *Wall Street Journal*, March 7, 2021, https://www.wsj.com/articles/china-targets-ai-chips-among-seven-battlefronts-in-tech-race-with-u-s-11615135881.

Figure 6: Semiconductor Industry Market Share by Subproduct



Source: "2020 State of the US Semiconductor Industry," Semiconductor Industry Association, https://www.semiconductors.org/wp-content/uploads/2020/06/2020-SIA-State-of-the-Industry-Report.pdf.

investment, overseas acquisitions, and purchase of foreign semiconductor equipment and software, and 2) a $28.9-billion semiconductor fund established in October 2019.[45]

While it remains far from achieving its goal of leading the global semiconductor industry, the Chinese government is doubling down on reducing external vulnerabilities by focusing on spurring domestic innovation to secure domestic supply chain. With potential long-term aspirations for sector dominance, this line of effort is causing concerns among the current key players in the global supply chain for semiconductors, including the United States and Japan.

The US semiconductor industry is a leading player in the global market, particularly in chip design and semiconductor manufacturing equipment (SME). Currently, US-headquartered semiconductor firms account for about 47 percent of the $412-billion global semiconductor market.[46] Intel, for instance, led global semiconductor sales ($69.8 billion) in 2019, followed by South Korea's Samsung ($55.6 billion), Taiwan Semiconductor Manufacturing Company (TSMC) ($34.7 billion),

45 Platzer, et al., "Semiconductors: US Industry, Global Competition, and Federal Policy."

46 Ezell, "An Allied Approach to Semiconductor Leadership."

and South Korea's SK Hynix ($22 billion).[47] Notably, however, more than 55 percent of US-headquartered firms actually do not operate fabrication plants (fabs), and instead outsource production to contractors in Singapore, Taiwan, South Korea, Japan, and, increasingly, China—the so-called "fabless-foundry model."[48] The expansion of this model, together with the relative lack of US federal funding for strategic sectors (of the kind and scale that China has rolled out) have contributed to growing concerns over the risks of geographic concentration of production in East Asia, and particularly Taiwan, the potential for backdoor Chinese manipulation, and the long-term loss of global technological leadership.[49]

Japan's role in the semiconductor supply chain is concentrated more upstream, focused on SMEs and semiconductor manufacturing materials, with fabs geared toward older types of semiconductors.[50] According to analysis by Georgetown University's Center for Security and Emerging Technology (CSET), Japanese firms dominate production of wafers, a key semiconductor material (56 percent of market share, compared to Taiwan, the closest competitor, at 16 percent).[51] They are second only to US firms in fabrication tools (24 percent, compared to the US 44 percent) and lead in assembly, testing, and packaging (ATP) tools (44 percent of the market, followed by the US 23 percent, with no other country exceeding 10 percent).[52] Japanese firms, along with Dutch companies, play a critical role in production of advanced lithography equipment, including extreme ultraviolet (EUV) scanners and argon fluoride (ArF) immersion scanners, which CSET identifies as China's greatest semiconductor supply-chain "chokepoint."[53] While neither Japan nor the United States has the highest-end pure-play foundries (which are the focus of Taiwanese and South Korean firms), their essential role in producing SMEs, in particular, gives them significant leverage over business in the downstream supply chain, including Chinese firms.[54]

US Strategy to Support the Semiconductor Industry

US government efforts to maintain US dominance in critical technologies have taken two different approaches, as mentioned above.

(1) Slow China's efforts to develop its high-tech sectors. The Trump administration's efforts to slow the development of China's high-tech sectors ramped up through measures such as strengthened investment screening and tightened export controls targeting Huawei and Semiconductor Manufacturing International Co. (SMIC). Some seventy Chinese companies were placed on the Commerce Department's Bureau of Industry and Security's Entity List from 2019 to 2020.[55] Under the Biden administration, the Department of Commerce added seven more Chinese tech companies and government laboratories to this list on April 8.[56]

(2) Boost US domestic capabilities by reshoring production. The United States has also encouraged foreign direct investment, which has seen TSMC announce plans to build a $12-billion fab in Arizona (its second plant in the United States) that would begin factory production in 2024.[57] On May 21, Samsung announced it will invest $17 billion in a new semiconductor foundry during ROK President Moon Jae-in's visit to Washington, DC; however, the company has not yet announced the final location.[58] In addition, Congress passed and incorporated language from the Creating Helpful Incentives to Produce Semiconductors for America Act (CHIPS for America Act) into the fiscal year 2021 (FY2021) National Defense Authorization Act (NDAA),

47 Ibid.

48 Chad P. Brown, Working Paper 20-16: *How the United States Marched the Semiconductor Industry into its Trade War with China, Peterson Institute for International Economics*, 2020, https://www.piie.com/sites/default/files/documents/wp20-16.pdf; Platzer, et al., "Semiconductors: US Industry, Global Competition, and Federal Policy."

49 Platzer, et al., "Semiconductors: US Industry, Global Competition, and Federal Policy."

50 Brown, *Working Paper 20-16*; Saif M. Khan, "The Semiconductor Supply Chain: Assessing National Competitiveness," Center for Security and Emerging Technology, Georgetown University, 2021, https://cset.georgetown.edu/research/the-semiconductor-supply-chain/.

51 Ibid.

52 Ibid.

53 Ibid.

54 Ibid.

55 Ting-Fang Chen, "China's Top Chipmaker SMIC Hit by US Export Controls," *Nikkei Asia*, September 26, 2020, https://asia.nikkei.com/Politics/International-relations/US-China-tensions/China-s-top-chipmaker-SMIC-hit-by-US-export-controls.

56 Nakashima, "Biden Administration Slaps Export Controls on Chinese Firms for Aiding PLA Weapons Development"; "Commerce Adds Seven Chinese Supercomputing Entities to Entity List for their Support to China's Military Modernization, and Other Destabilizing Efforts," US Department of Commerce, 2021, https://www.commerce.gov/news/press-releases/2021/04/commerce-adds-seven-chinese-supercomputing-entities-entity-list-their#:~:text=Today's%20final%20rule%20adds%20the,the%20National%20Supercomputing%20Center%20Wuxi%2C.

57 "Phoenix Okays Development Deal with TSMC for $12 Billion Chip Factory," Reuters, November 18, 2020, https://www.reuters.com/article/us-tsmc-arizona/phoenix-okays-development-deal-with-tsmc-for-12-billion-chip-factory-idUSKBN27Y30E.

58 Joyce Lee, "S.Korea seeks tax cuts for U.S. investment by firms such as Samsung," Reuters, May 21, 2021, https://www.reuters.com/article/idCAKCN2D21TV-OCATC?edition-redirect=ca.

authorizing an array of R&D initiatives, as well as a subsidy program for domestic semiconductor manufacturers.[59] While the NDAA did not specify a level of funding for these efforts, Biden's proposed infrastructure plan includes $50 billion for semiconductor manufacturing and research.

At the same time, increased geopolitical uncertainty and risks of supply-chain disruption have led the US private sector to invest in semiconductor manufacturing in the United States and other Western countries. Intel announced a major investment of $20 billion to build two new semiconductor factories in Arizona in March 2021, and expects to begin production in 2024. It is also launching Intel Foundry Services to produce chips in both the United States and Europe to supply other companies. Moving into the foundry business (producing chips for other firms) is a major shift in Intel's business model, as it had been an integrated device manufacturer, designing and making chips for its own use.[60] Intel's announcement came amid a global chip shortage and signaling from the Biden administration that it wants to secure the semiconductor supply chain.[61] If successful, this may offer a US- and Europe-based alternative to chip factories in Asia.[62]

Japanese Strategy to Support Semiconductor Industry

As discussed above, the Japanese government has provided subsidies to promote relocation of Japanese semiconductor manufacturing out of China. A handful of moves by Japanese firms in response to government subsidies (discussed in the previous section) helped shape the narrative that Japanese semiconductor firms are eager to depart China en masse and can be motivated effectively by government actions. Osaka-based semiconductor equipment-manufacturing firm Fujikin Inc. reportedly received subsidies to cover two thirds of the cost of moving a portion of its production from China to Vietnam.[63] Similarly, Uyemura & Co., a chemical manufacturer that provides electroplating services to bind chip components, received a "China-exit" subsidy to diversify sources of raw materials and conduct its inspection process in house.[64] Mitsubishi Electric also received a subsidy, which it says will go toward the acquisition of a factory in Hiroshima Prefecture that produces semiconductors for electric power generation.[65] However, these moves by a few firms that supply major Japanese semiconductor companies do not appear to constitute a major strategic shift by the Japanese semiconductor industry as a whole. Indeed, no major Japanese semiconductor firms have announced that they will exit the Chinese market since these subsidies were announced.

Along with reshoring measures, METI has also been trying to attract foreign direct investments in advanced chipmaking.[66] One of the measures appears to be a decision early this year to increase government funding for developing advanced semiconductor-manufacturing technology in Japan.[67] METI's efforts have reportedly led to the Taiwanese semiconductor firm TSMC's decision in February 2021 to build a $171-million semiconductor R&D facility in Japan. While Tokyo has said the subsidy is also available to TSMC, it remains unclear at the time of writing whether TSMC has agreed to take the funding.[68]

Japan has also committed to cooperate with the Biden administration on semiconductor supply chains, as Biden and Suga noted at the joint press conference.[69] The Japanese government recognizes that, as US Secretary of State Antony Blinken has argued, further actions will require leveraging the combined supply-chain efforts of "techno-democracies" over "techno-autocracies." This will require deeper multilateral engagement and cooperation, and not just unilateral US

59 James Andrew Lewis, "Semiconductors and Modern Defense Spending," Center for Strategic and International Studies, September 8, 2020, https://www.csis.org/analysis/semiconductors-and-modern-defense-spending.

60 Patrick McGee, "Intel to Step up Chip Manufacturing with $20bn Plants," *Financial Times*, March 23, 2021, https://www.ft.com/content/987b5761-6b59-48f3-8f52-52a4fb84264e.

61 Jacky Wong, "TSMC Still Has the Edge Over Intel in Brewing Foundry Fight," *Wall Street Journal*, March 25, 2021, https://www.wsj.com/articles/tsmc-still-has-the-edge-over-intel-in-brewing-foundry-fight-11616673102.

62 Kif Leswing, "Intel is Spending $20 Billion to Build Two New Chip Plants in Arizona," CNBC, March 23, 2021, https://www.cnbc.com/2021/03/23/intel-is-spending-20-billion-to-build-two-new-chip-plants-in-arizona.html.

63 Yuko Takeo and Michelle Jamrisko, "Japan's Push to Cut China Reliance Boosts Southeast Asia," Bloomberg, August 6, 2020, https://www.bloomberg.co.jp/news/articles/2020-08-07/QENYWGT0G1L801.

64 Francesca Regalado, "Japan Chip Suppliers Reap Benefits of 'China Exit' Subsidy," *Nikkei Asia*, January 25, 2021, https://asia.nikkei.com/Economy/Trade/Japan-chip-suppliers-reap-benefits-of-China-exit-subsidy.

65 Ibid.

66 Sugihara, "Japan Seeks Shot in the Arm from TSMC to Revive Chipmaking Sector."

67 "Taiwan TSMC to establish R&D base in Tsukuba, Ibaraki," *NHK*, February 10, 2021, https://www3.nhk.or.jp/news/html/20210210/k10012858561000.html.

68 Ibid.

69 "Remarks by President Biden and Prime Minister Suga of Japan at Press Conference," White House, April 16, 2021, https://www.whitehouse.gov/briefing-room/speeches-remarks/2021/04/16/remarks-by-president-biden-and-prime-minister-suga-of-japan-at-press-conference/.

blacklisting.[70] In particular, Japanese cooperation is critical because of the influence Japanese firms wield over the semiconductor supply chains to China, including in the production of SME, special chemicals, materials, and advanced backend packaging.[71]

While the US and Japanese governments are pursuing tech cooperation with other trusted partners, private firms' willingness and ability to restrict sales to Chinese companies or diversify out of the Chinese market in the long term remain unclear. In June 2019, Tokyo Electron, the world's third-largest supplier of SME, announced that it would comply with US law and refuse to supply equipment to blacklisted Chinese companies.[72] However, China still remains a top market for Tokyo Electron, as well as other major Japanese semiconductor firms.[73] Indeed, as China began increasing purchases of SMEs since 2020, Tokyo Electron and fellow Japanese SME firm Disco reportedly expanded production facilities to meet this increasing demand in April.[74] Semiconductor firms outside Japan, such as the Dutch firm ASML (the world's only supplier of EUV SME) recently announced that it extended a deal to sell equipment to the blacklisted SMIC.[75] Meanwhile, TSMC has suspended sales to Huawei in accordance with Trump's sanctions in 2020, but China still drives 20 percent of its sales and remains a growing market for the Taiwanese company.[76]

Case Study 2. Rare Earths

The United States and many of its partners and allies are also concerned about China's current domination of the rare-earths supply chain, both in mining and processing, as well as rare-earth permanent magnet manufacturing (see Figure 7 for a simple representation of the rare-earth supply chain). Rare-earth elements are required for the production of a wide range of technologies underpinning national security and economic competitiveness, including semiconductors, electric vehicles and motors, computers, wind turbines, screens, scientific instruments, advanced military equipment, and more.[77] While abundant in quantity across the globe, they are often found in low concentrations and mixed with other materials, making their extraction and processing difficult and costly.[78] This is one among several reasons why China dominates 70 percent of global rare-earth mining.[79] In downstream stages of the rare-earth supply chain, China accounts for 80 percent of refining, and 90 percent of separation into individual elements.[80]

Given high US dependence on Chinese rare earths, China's willingness to implement export controls has made the Pentagon increasingly concerned.[81] There are several reasons why the Chinese government may restrict its rare-earth exports. First, while being a top producer of rare earths and related products, China since 2018 has also become a net

70 Jeanne Whalen, "Biden Likely to Remain Tough on Chinese Tech like Huawei, but with More Help from Allies," *Washington Post*, November 16, 2020, https://www.washingtonpost.com/technology/2020/11/16/biden-huawei-trump-china/.

71 "Japan Chipmaking Equipment Surging on Chinese Demand," *Nikkei Asia,* October 12, 2016, https://asia.nikkei.com/Economy/Japan-chipmaking-equipment-surging-on-Chinese-demand.

72 Makiko Yamazaki, "Exclusive: Top Japanese Chip Gear Firm to Honor US Blacklist of Chinese Firms," Reuters, June 11, 2019, https://www.reuters.com/article/us-usa-trade-china-semiconductors-exclus/exclusive-top-japanese-chip-gear-firm-to-honor-u-s-blacklist-of-chinese-firms-executive-idUSKCN1TC0H6.

73 David P. Goldman, "Tokyo Electron Shares Soar Due to US Restrictions," *Asia Times*, July 9, 2020, https://asiatimes.com/2020/07/tokyo-electron-shares-soar-due-to-us-restrictions/.

74 Masaya Sato, "Mainland China Passes Taiwan as Top Market for Chipmaking Gear," *Nikkei Asia,* April 15, 2021, https://asia.nikkei.com/Business/Tech/Semiconductors/Mainland-China-passes-Taiwan-as-top-market-for-chipmaking-gear.

75 Stephen Nellis, "ASML Extends Sales Deal with Chinese Chipmaker SMIC to End of 2021," Reuters, March 3, 2021, https://www.reuters.com/article/us-asml-holding-smic-idUSKBN2AV1S6.

76 Eleanor Olcott, "TSMC faces pressure to choose a side in US-China tech war," *Financial Times*, April 15, 2021, https://www.ft.com/content/b452221a-5a82-4f5d-9687-093b9707e261.

77 "Explainer: China's Rare Earth Supplies Could Be Vital Bargaining Chip in US Trade War," Reuters, May 30, 2019, https://www.reuters.com/article/us-usa-china-rareearth-explainer/explainer-chinas-rare-earth-supplies-could-be-vital-bargaining-chip-in-u-s-trade-war-idUSKCN1T00EK.

78 Valerie Bailey Grasso, "Rare Earth Elements in National Defense: Background, Oversight Issues, and Options for Congress," Congressional Research Service, December 23, 2013, https://fas.org/sgp/crs/natsec/R41744.pdf; "Rare Truths About China's Rare Earths," *Wall Street Journal*, March 3, 2021, https://www.wsj.com/articles/rare-truths-about-chinas-rare-earths-11614814070; Charles Homans, "Are Rare Earth Elements Actually Rare?" *Foreign Policy,* June 15, 2010, https://foreignpolicy.com/2010/06/15/are-rare-earth-elements-actually-rare/.

79 Jamil Hijazi and James Kennedy, "How the United States Handed China its Rare Earth Monopoly," *Foreign Policy*, October 27, 2020, https://foreignpolicy.com/2020/10/27/how-the-united-states-handed-china-its-rare-earth-monopoly/.

80 Ibid.

81 Sun Yu, "China Targets Rare Earth Export Curbs to Hobble US Defence Industry," Financial Times, February 16, 2021, https://www.ft.com/content/d3ed83f4-19bc-4d16-b510-415749c032c1.

What Are Rare Earth Elements?

Rare earths are a group of seventeen elements that are critical input materials used in a wide range of technologies underpinning national security and economic competitiveness, including semiconductors, electric-vehicle batteries and motors, computers, wind turbines, screens, scientific instruments, advanced military equipment, and more.[1] They are identified as critical minerals by the US Geological Survey, pursuant to Executive Order 13817.[2]

Rare earths are typically categorized as either light or heavy rare earths. Heavy rare earths are usually more expensive because they are found in lower concentrations in the Earth's crust.

Light rare earths include: lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), and gadolinium (Gd).

Heavy rare earths include: terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), lutetium (Lu), and yttrium (Y).

Rare earths have both important commercial and military applications. Ordinarily, a combination of light and heavy earths is used to make components in many of these technologies.

China is not only a major producer of rare earths, but also dominates in several processing stages. Countries around the world depend, to a large extent, on China's rare-earth products. In 2019, the United States imported 100 percent of rare-earth metals and compounds it consumed, and China has been a significant source of heavy rare earths, as well as other downstream products containing rare earths such as permanent magnets.[3] Japan also depends on China for heavy rare earths and other processed goods, such as rare-earth metals/alloys and magnets.

While estimating the precise numerical value of US dependence on China for rare earths is beyond the scope of this publication, several data points and industry trends suggest a significant level of US dependence on China from the upstream to downstream of the rare-earth supply chain. Between 2015 and 2018, China was the source of 80 percent of US imports of rare-earth oxides, which make up only a part of US imports of rare earths and other rare-earth-related products. In 2019, lanthanum accounted for the largest share of China's rare-earth exports (11,030 metric tons, 56.9 percent) to the United States, followed by yttrium (24.2 percent), praseodymium (20.5 percent), cerium (20 percent), europium (15.1 percent), terbium (6.4 percent), and neodymium (1.8 percent).[4] Finally, according to the Commerce Department's 2016 "US Strategic Material Supply Chain Assessment," out of one hundred and sixty US respondent firms in manufacturing, distribution, and end-use/application involving rare earths, sixty-six firms imported rare-earth products—and twenty-eight of them imported solely from China.[5]

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1 "Explainer: China's Rare Earth Supplies Could Be Vital Bargaining Chip in US Trade War."

2 "Final List of Critical Minerals 2018," Department of the Interior, 83 *Federal Register* 23295, 2018.

3 Brandon S. Tracy, "An Overview of Rare Earth Elements and Related Issues for Congress," Congressional Research Service, November 24, 2020, https://crsreports.congress.gov/product/pdf/R/R46618.

4 "Does China Pose a Threat to Global Rare Earth Supply Chains?" China Power, Center for Strategic and International Studies, July 17, 2020, https://chinapower.csis.org/china-rare-earths/.

5 These products include "[Rare Earth Element]-related ore, mixed compound, inorganic purified compound, organic purified compound, mixed metal, and/or purified metal." Brad Botwin, "US Strategic Material Supply Chain Assessment: Select Rare Earth Elements—Dysprosium, Erbium, Neodymium, Terbium, and Ytterbium," US Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, 2016, https://www.bis.doc.gov/index.php/documents/technology-evaluation/2188-rare-earth-supply-chain-assessment/file.

What Are Rare Earth Elements?

The United States currently depends on China for rare-earth processing, rare-earth magnet manufacturing, and supply of heavy rare earths. Heavy rare earths such as dysprosium, yttrium, and terbium are vital inputs for permanent magnets that have both important commercial and military applications.[6] Dysprosium and terbium, for instance, are input materials for permanent magnets that are not only widely used in consumer electronics and electric vehicles, but also in electric motors contained in latest-generation jet fighters and destroyers.[7] China and Myanmar are currently thought to dominate global supply of these heavy rare-earth materials.[8] In the case of yttrium, China accounted for 94 percent of US imports between 2016 and 2019.[9] While rare-earth deposits containing heavy rare earths exist in the United States, the problem has been that developing processing facilities for such materials and the capacity for manufacturing rare-earth magnets in the United States has been commercially difficult.[10]

6 Rare-earth-related technologies and products often contain a combination of several rare-earth elements, both heavy and light. For instance, yttrium is an input material for developing lasers used for targeting weapons and radar. Grasso, "Rare Earth Elements in National Defense: Background, Oversight Issues, and Options for Congress."

7 "Argus White Paper: Mixed Prospects for China's Rare Earths Market Amid Covid-19," *Argus*, June 2020, https://www.argusmedia.com/-/media/Files/white-papers/argus-white-paper-mixed-prospects-for-chinas-rare-earths-market-amid-covid-19.ashx; Grasso, "Rare Earth Elements in National Defense: Background, Oversight Issues, and Options for Congress."

8 "Argus White Paper: How to Build a Rare Earth Supply Chain," *Argus*, July 2020, https://view.argusmedia.com/rs/584-BUW-606/images/MET-White_paper-How_to_build_a_rare_earth_supply_chain.pdf.

9 "Nearly all imports of yttrium metal and compounds are derived from mineral concentrates processed in China. Import sources do not include yttrium contained in value-added intermediates and finished products." Joseph Gambogi, "Yttrium," US Department of the Interior, US Geological Survey, 2021, 1–2, https://pubs.usgs.gov/periodicals/mcs2021/mcs2021-yttrium.pdf.

10 Such deposits include the Bokan Mountain in Alaska and Round Top in Texas. Although the Pentagon has awarded a grant to MP Materials operating in Mountain Pass to make a separation plant for heavy rare earths, Mountain Pass in California is thought to contain very little heavy rare-earth content. Tracy, "An Overview of Rare Earth Elements and Related Issues for Congress; "Argus White Paper: How to Build a Rare Earth Supply Chain"; David Kramer, "US Government Acts to Reduce Dependence on China for Rare-Earth Magnets," *Physics Today*, February 1, 2021, https://physicstoday.scitation.org/doi/10.1063/PT.3.4675.

importer of seven rare-earth elements used in the production of permanent magnets, and is expected by some analysts to become a net importer of all rare-earth materials by 2030.[82] As domestic and global demand for rare earths rises, China may be tempted to secure its own supply of rare earths by curbing its exports. Since 2007, the Chinese government has attempted to do so for a wide range of raw materials, including rare earths, of which it was a major producer, by dramatically increasing export duties on them.[83] The US government adjudicated against these measures at the World Trade Organization on two separate occasions, in 2009 and 2012.[84]

Second, China may also weaponize its rare-earth exports to the United States to demand concessions or to deter certain actions, as seen in 2010 when China temporarily cut off its rare-earth exports to Japan in apparent response to a maritime territorial dispute. More recently, as strategic competition and trade wars have continued, China was reportedly exploring restricting its rare-earth exports to other countries, including the United States.[85] In January 2021, China's Ministry of Industry and Information Technology also proposed draft controls on the production and export of rare-earth minerals in China.[86]

82 Morgan Summers, "Rare Earth Markets and Embedded Demand," National Energy Technology Laboratory, US Department of Energy, April 10, 2019, https://www.netl.doe.gov/sites/default/files/2019-05/2019_Annual_Reports/Wednesday/REE/12%20-%20REE%20Review%20Presentation_Summers%2020190408.pdf.

83 Jason Garred, "The Persistence of Trade Policy in China After WTO Accession," Working Papers 1621E, University of Ottawa, Department of Economics, 2016, https://ideas.repec.org/p/ott/wpaper/1621e.html.

84 "China—Rare Earths," World Trade Organization, 2019, https://www.wto.org/english/tratop_e/dispu_e/cases_e/1pagesum_e/ds431sum_e.pdf; "China—Measures Related to the Exportation of Various Raw Materials," World Trade Organization, 2013, https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds394_e.htm.

85 "Explainer: China's Rare Earth Supplies Could Be Vital Bargaining Chip in US Trade War."

86 Yu, "China Targets Rare Earth Export Curbs to Hobble US Defence Industry."

Figure 7: A Simple Representation of the Rare-Earth Supply Chain

Source: Tobin Hansen, "Securing US Access to Rare Earth Elements," Defense 360, March 2020, http://defense360.csis.org/wp-content/uploads/2020/03/Hansen_Rare-Earth_v1.pdf.

The US government is prioritizing a strategy to reduce its dependence on China, which in the case of rare-earth supply chain has included government support for investments in mining and processing in the United States and in partner countries. As mentioned above, President Biden issued an executive order to review US vulnerability of critical supply chains, including rare earths, which includes government subsidies for some mining and processing companies. Three North American companies, including Neo Performance Materials of Canada and Energy Fuels of the United States, are setting up a rare-earth supply chain to reduce dependence on China.[87]

It is important to understand how China came to dominate the production of rare earths.[88] China's current leverage over the supply chain has less to do with inherent geological advantage than other factors. Rare earths are not actually rare, and can be found globally—including in the United States. In fact, from the 1960s to the 1980s, the United States was the leader in global rare-earth production. However, environmental issues and market forces drove mining and refining out of the United States and Australia.[89] Specifically, as the United States and other Western countries began tightening environmental regulation of the industry, the cost of production rose, driving the industry to China, where regulations were weak and labor costs low.[90] At the same time, China was focused on building its rare-earth industry, including through export quotas beginning in the late 1990s, only beginning to impose stricter environmental and resource-sustainability policies in the early 2000s. In this sense, diversifying the rare-earth supply chain away from China is not impossible. However, there were commercial and environmental motivations for allowing it to shift toward China in the first place.[91] With this caveat in mind, it is useful to examine how Japan and the United States have been grappling with the question of what to do about the rare-earth supply chain in recent years.

Japan

Japan has been grappling with rare-earth supply-chain insecurity since at least 2010, when China temporarily restricted rare-earth shipments to Japan due to developments in a maritime territorial dispute.[92] This action generated interest from Tokyo in reducing supply-chain dependence on China, and resulted in a number of government and private-sector actions to achieve this goal. First, the Japanese government allocated significant financial resources to address the rare-earth supply-chain issue. It committed $1.25 billion to mitigate future disruptions, with $490 million allocated toward technological innovation for recycling and improved efficiency, and $370 million to support offshore rare-earth mining ventures.[93]

87 Andy Bounds, "North American Groups Seek to Break China's Grip on Rare Earths Supply," *Financial Times*, March 1, 2021, https://www.ft.com/content/bd6aaf57-0c64-4922-b1d0-6149e7d4b7cc.

88 "Rare Truths About China's Rare Earths"; Homans, "Are Rare Earth Elements Actually Rare?"

89 Tomio Shida, "History Offers Lessons in Escaping China's Rare-Earth Dominance," *Nikkei Asia*, June 25, 2019, https://asia.nikkei.com/Economy/Trade-war/History-offers-lessons-in-escaping-China-s-rare-earth-dominance2.

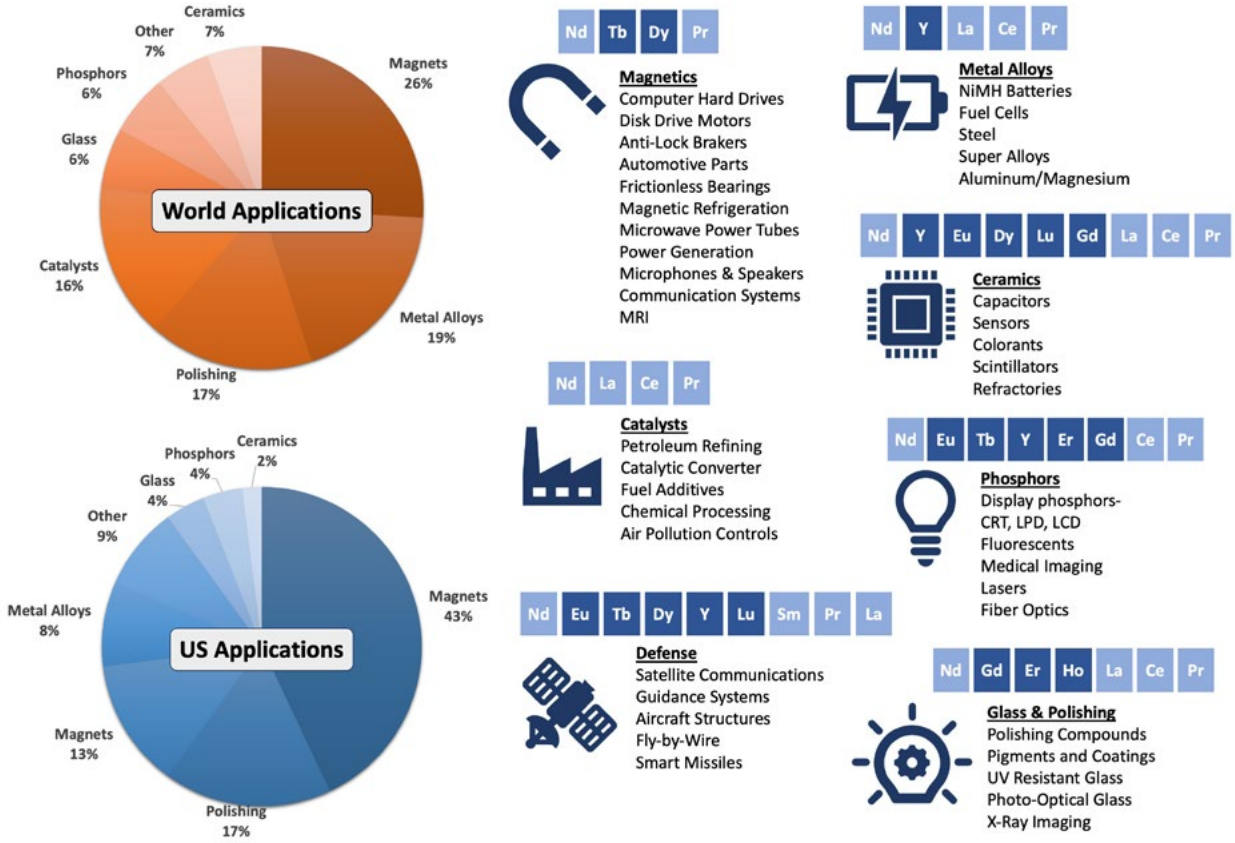
90 https://fas.org/sgp/crs/natsec/R41744.pdf CRS report

91 For a detailed explanation of the history of the rare earth supply chain see Julie Klinger's *Rare Earth Frontiers*. Julie Michelle Klinger, Rare Earth Frontiers, (Ithaca: Cornell University Press, 2018).

92 Hiroko Tabuchi, "Japan Calls on China to Resume Rare Earth Exports," *New York Times*, October 24, 2010, https://www.nytimes.com/2010/10/25/business/global/25rare.html; Keith Bradsher, "China Still Bans Rare Earth to Japan," New York Times, November 10, 2010, https://www.nytimes.com/2010/11/11/business/global/11rare.html.

93 David Uren, "Rare Earths: Is There a Case for Government Intervention?" United States Studies Centre, University of Sydney, 2019, https://www.ussc.edu.au/analysis/rare-earths-is-there-a-case-for-government-intervention.

Figure 8: An Overview of Rare-Earth Global Demand and Domestic Consumption



Source: "REE-CM Program," National Energy Technology Laboratory (NETL), https://www.netl.doe.gov/coal/ rare-earth-elements/program-overview/background.

Then, in 2012, the Ministry of Education, Culture, Science, and Technology (MEXT) launched the Elements Strategy Initiative, a ten-year R&D project focused on substitution, regulation, reduction, and recycling, including aims to replace rare-earth elements with more readily available, less environmentally damaging materials.[94] More recently, in 2020, Tokyo was reportedly planning to take greater control of managing the country's strategic stockpiles of rare earths, as well as other important metals such as cobalt, including increasing target levels for stocks, revamping plans for procurement and release of supplies from reserves.[95]

Japan also sought to diversify its rare-earths supply by investing in overseas rare-earths projects, particularly in Australia through the state-owned Japan Oil, Gas, and Metals National Corp. (JOGMEC). In 2010, JOGMEC assisted the Sojitz Corporation in investing $250 million in the Australian rare-earths mining company Lynas to accelerate expansion of a mine on Mount

94 Eiichi Nakamura and Kentaro Sato, "Managing the Scarcity of Chemical Elements," *Nature Materials* 10, February 21, 2011, 158–161, https://doi.org/10.1038/nmat2969; "Overview of the Initiative," Element Strategy Initiative: To Form Core Research Centers, Ministry of Education, Culture, Sports, Science, and Technology (MEXT), https://elements-strategy.jp/en/about/outline.

95 Reiko Suda, "Japan to Strengthen Control over Rare Metal Reserves," *Argus*, July 3, 2020, https://www.argusmedia.com/en/news/2120125-japan-to-strengthen-control-over-rare-metal-reserves#:~:text=Japan%20is%20planning%20to%20ramp,geopolitical%20instability%20or%20future%20pandemics.

Weld in Western Australia. Under the deal, Sojitz served as the distribution company, with an agreement to supply to Japan more than nine thousand tons per year for ten years following the start of operation.[96] Lynas currently supplies close to one third of Japan's imports.[97] The investment also helped fund the construction of a processing plant in Kuantan, Malaysia.[98] In 2019, Lynas restructured $147 million worth of debt and, as part of the restructuring, agreed to "supply up to 7,200 tons a year to Japan until 2038, doubling the supply priority for Japan from their previous agreement, which covered the period to 2025."[99] The debt-restructuring deal would also support the company's plan to spend $500 million by 2024 on US and Malaysian value-added processing, and to create a processing plant near Mount Weld.[100]

More recently, the Suga administration appears to be interested in expanding government support toward diversifying rare-earth supply. In April 2021, Nikkei Asia reported that the Suga administration was considering the removal of a 50-percent limit on state funding for natural-resource exploration projects, which would open up the way for JOGMEC to take on more than half of the costs for financing such projects. Finally, Tokyo has also reportedly been in talks with Washington and Canberra regarding cooperation on strategic investments in rare-earth processing facilities located in the United States and Australia.[101]

Finally, Japanese firms have been looking to India and Vietnam, among other countries, as potential suppliers of rare earths. Notably, after Abe and Indian Prime Minister Narendra Modi agreed to begin joint production of rare earths in 2015, an Indian subsidiary of Toyota Tsusho began full-scale production of four rare earths, including neodymium, in 2016.[102] Likewise, Japan made an agreement in 2010 with Vietnam, home to the largest rare-earth reserve in the world after China, to start working together to mine rare earths.[103] Later, in 2014, the two countries launched a joint rare-earth and technology-transfer center in Hanoi.[104]

Japan's collective efforts since 2010 have resulted in some success in diversifying its existing rare-earth supply chain. While Japan relied on China for 82 percent of its rare earths in 2010, that reliance dropped to 58 percent in 2019, with the government announcing its plan to achieve less than 50-percent reliance by 2025.[105] Japan's rare-earth initiatives with Australia and India also present further opportunities to explore deeper strategic economic cooperation among the four countries comprising the Quad (the United States, Japan, Australia, and India). Despite this progress, however, Japan still relies on China for its heavy rare earths in particular, and still lacks a robust productive capacity in the downstream segments of rare-earths production. These opportunities and challenges will be further discussed in tandem with the United States' needs on rare-earth supply chains in the policy-recommendation section below.

United States

The US government has set as a policy priority diversifying away from relying on China for rare-earth imports and increasing mining and processing domestically and in partner countries. Its concerns about the risks associated with dependence on China for rare earths go back more than a decade, but were

96 "Agreement to Form Strategic Alliance with Lynas, an Australian Rare Earths Company, Concerning Rare Earths Supply for the Japanese Market and Supporting the expansion of Lynas Rare Earths Project," Lynas Corporation Limited, Sojitz Corporation, November 24, 2010, https://www.sojitz.com/en/news/2010/11/20101124.php.

97 "Does China Pose a Threat to Global Rare Earth Supply Chains?"

98 Melanie Burton, Yuka Obayashi, and Aaron Sheldrick, "How Rare Earth Shocks Lifted an Upstart Australian Mining Company," Reuters, December 17, 2019, https://www.reuters.com/article/us-rareearths-lynas-focus-idUSKBN1YL0R0.

99 "Rare Earths Producer Lynas Secures Better Loan Terms with Japanese Backers," Reuters, June 26, 2019, https://www.reuters.com/article/us-lynas-corp-japan-debt/rare-earths-producer-lynas-secures-better-loan-terms-with-japanese-backers-idUSKCN1TS00Q.

100 Colin Kruger, "Lynas Boss Defends Equity Raising to Fund Expansion," *Sydney Morning Herald*, November 26, 2020, https://www.smh.com.au/business/companies/lynas-defends-equity-raising-to-fund-expansion-20201126-p56i78.html.

101 Hanafusa, "Japan to Pour Investment into Non-China Rare-Earth Projects."

102 Shida, "History Offers Lessons in Escaping China's Rare-Earth Dominance"; "Japan to Import Rare Earth from India—Nikkei," Reuters, August 27, 2014, https://www.reuters.com/article/rare-earths-japan-india/japan-to-import-rare-earth-from-india-nikkei-idINKBN0GS04L20140828.

103 Yoko Kubota, "Vietnam and Japan to Mine Rare Earths Together," Reuters, October 30, 2010, https://www.reuters.com/article/us-japan-vietnam/vietnam-and-japan-to-mine-rare-earths-together-idUSTRE69U05F20101031.

104 Nabeel A. Mancheri and Tomoo Marukawa, "Rare Earth Elements: China and Japan in Industry, Trade and Value Chain," Institute of Social Science, University of Tokyo, 2016, 74, https://web.iss.u-tokyo.ac.jp/kyoten/research/%E7%8F%BE%E4%BB%A3%E4%B8%AD%E5%9B%BD%E7%A0%94%E7%A9%B6%E3%82%B7%E3%83%AA%E3%83%BC%E3%82%BANo17(new).pdf.

105 Chikako Mogi, "Japan Rare Earths Imports from China Jump in Dec," Reuters, January 31, 2011, https://www.reuters.com/article/japan-rareearth/japan-rare-earths-imports-from-china-jump-in-dec-idUSTOE6BQ02V20110131; Hanafusa, "Japan to Pour Investment into Non-China Rare-Earth Projects."

intensified during the Trump administration.[106] In response to an executive order, in 2018 the Defense Department published "Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States," which listed among its key findings the growing risk of US overreliance on China for strategic and critical materials, including rare earths.[107] In 2020, Trump issued another executive order targeting rare earths more specifically, with the objective of rebuilding domestic production.[108]

Following this increased interest in rare earths, multiple government agencies rolled out measures to improve the security of the United States' rare-earth supply chains. The Department of Defense has been a major actor in this effort. In 2020, the department funded feasibility and engineering studies for a rare-earth processing facility in Mountain Pass mine in California, the only domestic location of rare earth production. While the precise amount of the grant remains undisclosed, the Pentagon said such grants usually offer between $5 million and $20 million.[109] Last summer, it also provided Australia's Lynas Rare Earths and MP Materials (operating the largest rare-earth mining operation outside of China in Mountain Pass) funding for production of heavy rare earths.[110] Then, in the fall, the Defense Logistics Agency "increased the scope of its Rare Earth Salts Rapid Innovation Fund (RIF) project to expand production to 20 tons per annum of neodymium praseodymium (NdPr). Under their RIF project, Rare Earth Salts has been scaling up capacity of its low capital and operating cost technology at its Beatrice, Nebraska facility."[111] Also in November, the Pentagon concluded a technology agreement worth $9.6 million with MP Materials to build processing and separation facilities for light rare-earth elements (LREE).[112] The Pentagon also signed agreements with TDA Magnetics of Rancho Dominguez, California, ($2.3 million) and Urban Mining Company of San Marcos, Texas, for rare-earth magnet "supply chain studies and inventory demonstrations."[113]

Other government agencies also contributed to this effort. In 2019, the State Department launched the Energy Resource Governance Initiative (ERGI). Under this initiative, the United States has sought to promote the development of minerals and metals sectors in countries endowed with these natural resources, but not developed at commercial scale.[114] Ten countries have joined the initiative, including Canada, Australia, Brazil, Botswana, Peru, Argentina, Democratic Republic of the Congo, Namibia, the Philippines, and Zambia.[115] Australia, Botswana, Canada, Peru, and the United States are the founding partners.[116] The White House's factsheet that followed the Leaders' Summit on Climate in April included a statement on ERGI, which said its focus will expand to include "greening mining operations, as well as re-use and recycling of key minerals and metals."[117] Also last year, the Department of Energy announced $18 million in funding for research on

106 Marc Humphries, "Rare Earth Elements: The Global Supply Chain," Congressional Research Service, December 16, 2013, https://fas.org/sgp/crs/natsec/R41347.pdf.

107 "Executive Order 13806 of July 21, 2017, Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States," *Federal Register* 82, 34597–34599, https://www.federalregister.gov/documents/2017/07/26/2017-15860/assessing-and-strengthening-the-manufacturing-and-defense-industrial-base-and-supply-chain.

108 Joe Gould and Aaron Mehta, "Trump Executive Order Targets Rare Earths Minerals and China," *Defense News*, October 1, 2020, https://www.defensenews.com/congress/2020/10/01/trump-executive-order-on-rare-earths-puts-material-risk-in-spotlight/.

109 Timothy Puko, "Pentagon Invests in Strategic Metals Mine, Seeking to Blunt Chinese Dominance," *Wall Street Journal*, April 26, 2020, https://www.wsj.com/articles/pentagon-invests-in-strategic-metals-mine-seeking-to-blunt-chinese-dominance-11587924001?mod=article_inline.

110 Ernest Shneyder, "Pentagon Resumes Rare Earths Funding Program after Review," Reuters, July 21, 2020, https://www.reuters.com/article/us-usa-rareearths/pentagon-resumes-rare-earths-funding-program-after-review-idUSKCN24M2Z4?edition-redirect=uk.

111 "DOD Announces Rare Earth Element Awards to Strengthen Domestic Industrial Base," US Department of Defense, November 17, 2020, https://www.defense.gov/Newsroom/Releases/Release/Article/2418542/dod-announces-rare-earth-element-awards-to-strengthen-domestic-industrial-base/.

112 Ibid.

113 Ibid.

114 "Energy Resource Governance Initiative (ERGI)," US Department of State, Bureau of Energy Resources, https://www.state.gov/wp-content/uploads/2019/06/Energy-Resource-Governance-Initiative-ERGI-Fact-Sheet.pdf.

115 "Nine Countries Join US Strategic Minerals Initiative," Reuters, September 26, 2019, https://www.reuters.com/article/usa-minerals-china/nine-countries-join-u-s-strategic-minerals-initiative-idUSL2N26G229.

116 "Meeting of the Founding Partners of the Energy Resource Governance Initiative (ERGI)," Department of Industry, Science, Energy and Resources, July 7, 2020, https://www.industry.gov.au/news-media/critical-minerals-facilitation-office-news/meeting-of-the-founding-partners-of-the-energy-resource-governance-initiative-ergi.

117 "Fact Sheet: President Biden's Leaders Summit on Climate," White House, April 23, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/23/fact-sheet-president-bidens-leaders-summit-on-climate/.

rare-earth mining, processing, and finding or developing effective substitutes.[118]

In his first one hundred days, President Biden, like Trump, has made clear that diversifying and securing rare-earth supply chains will remain a priority under his administration. Biden's executive order on supply chains explicitly identifies the rare earths as key "strategic materials" requiring in-depth analysis of supply-chain risks and policy recommendations from the Pentagon.[119] This was followed by reporting ahead of the inaugural Quad Summit in March 2021 that the four member countries would announce a new effort to build a rare-earth procurement chain.[120] While the fact sheet that followed the meeting did not specifically mention rare earths, its announcement of the creation of a working group for critical and emerging technologies opened the door for deeper cooperation on supply chains, including rare earths, among the four countries.[121] Similarly, the joint statement released following the Biden-Suga summit in April 2021 did not mention rare earths explicitly, but emphasized cooperation on supply chains for critical and emerging technologies, underscoring the allies' shared priorities and leaving the door open for deeper cooperation.[122]

Overall, actions by both the US and Japanese governments have clearly demonstrated their common interest in diversifying the rare-earth supply chain in order to offset the perceived risks of dependence on China. This shared interest creates new opportunities to pursue bilateral cooperation within the alliance, as well as expanded multilateral cooperation through the Quad, among leading techno-democracies, and beyond. Ultimately, however, the technical issues surrounding the rare-earth supply chain are complex, and the commercial and defense industrial requirements for particular types and quantities of rare earths are diverse. That means that there can be no single, simple policy solution. Actionable policy recommendations for the US-Japan alliance to develop and implement options for rare-earth supply-chain cooperation are detailed in the next section.

POLICY RECOMMENDATIONS

In light of the analysis presented in this issue brief, the United States and Japan should do the following.

- Operationalize the April 2021 US-Japan Joint Leaders' Statement by establishing a bilateral interagency Supply Chain Steering Committee that includes sector-specific working groups to enhance public-private partnerships in high-technology industries, including semiconductors and rare earths
    - While the steering committee will be government led, the working groups should engage directly with the private sector, serving as a consultative body with leading US and Japanese firms and industry associations to develop measures that increase the resilience and security of existing supply chains, at a manageable cost and with realistic timelines.
    - The steering committee should form the first bilateral link in an emerging global network of techno-democracies that cooperate to set standards and facilitate the development of supply chains for critical and emerging technologies with trusted partners.
    - The sector-specific working groups should develop specific measures that increase the resilience and security of the rare earth and semiconductor supply chains, including
        - joint investment in advanced semiconductor R&D, advanced workforce development, and developing substitute products and materials for existing rare-earth products;
        - co-investment in longer-term "moonshot" projects, such as high-end semiconductor

118 "Department of Energy to Provide $18 Million for Research on Critical Materials," US Department of Energy, April 14, 2020, https://www.energy.gov/articles/department-energy-provide-18-million-research-critical-materials#:~:text=WASHINGTON%2C%20D.C.%20%E2%80%93%20Today%2C%20the,of%20the%20modern%20US%20economy.

119 Exec. Order No. 14017, 3 C.F.R. (2021), https://www.govinfo.gov/content/pkg/DCPD-202100163/pdf/DCPD-202100163.pdf.

120 "Quad Tightens Rare-Earth Cooperation to Counter China," *Nikkei Asia*, March 11, 2021, https://asia.nikkei.com/Politics/International-relations/Indo-Pacific/Quad-tightens-rare-earth-cooperation-to-counter-China.

121 "Quad Leaders' Joint Statement: 'The Spirit of the Quad,'" White House, March 12, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/12/quad-leaders-joint-statement-the-spirit-of-the-quad/#:~:text=1.&text=On%20this%20historic%20occasion%20of,defining%20challenges%20of%20our%20time.

122 "US- Japan Joint Leaders' Statement: US—Japan Global Partnership for a New Era," White House, April 16, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/16/u-s-japan-joint-leaders-statement-u-s-japan-global-partnership-for-a-new-era/.

manufacturing, and rare-earth processing and magnet manufacturing;[123]

- monitoring and sharing supply-chain intelligence on both existing and emerging non-market risks that threaten to disrupt critical supply chains;
- monitoring and engaging on government policies, including tariffs, government procurement, or other measures that could impede efforts to strengthen supply chains;
- formulating emergency sharing arrangements for strategic stockpiles such as heavy rare earths; and
- coordinating, when necessary, on the implementation of export-control measures regarding semiconductor products.

- The steering committee should also consider launching a new joint initiative, in collaboration with sector-specific working groups, to map global supply-chain networks of critical technologies to provide more detailed understanding of specific points of vulnerability and opportunities for diversification.

- Expand bilateral supply-chain cooperation into multilateral cooperative efforts through flexible and informal frameworks, beginning with semiconductors and rare earths.
  - The multilateral frameworks should be adaptable, informal, and open to structural adjustments, such as having further targeted sector- or industry-specific sub-working groups, in recognition that potential new member countries' interests and commitment may vary depending on the issue area.
  - On semiconductors, the United States and Japan should integrate major players such as South Korea, Taiwan, the Netherlands, and the United Kingdom into the working group to identify shared geopolitical risks in their supply chains and explore ways to collaborate to develop a secure, multilateral ecosystem for semiconductors among trusted partners.
  - On rare earths, they should advocate for the establishment of a separate Quad Working Group on Rare Earths, either as a new effort or a sub-group within the recently announced Quad Working Group on Critical and Emerging Technology.
  - The United States and Japan should also leverage both countries' strong track records of investment in Southeast Asia to facilitate the expansion of the region's supply-chain capacity by coordinating expanded multilateral investment in their industrial and human capital. The two countries should work together to realize a "China plus one" strategy in Southeast Asia as a means of diversifying supply chains for critical industries and mitigating risks associated with supply-chain disruption.

123 Ezell, "An Allied Approach to Semiconductor Leadership," 28.

COMMENTATORS *(Alphabetical Order)*

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The views and opinions expressed in this report are those of the authors, and do not necessarily reflect those of commentators or the organizations with which they are affiliated.

Jeffrey Bean, visiting fellow, East West Center

Robert Dohner, former deputy assistant secretary, US Department of the Treasury; nonresident senior fellow, Asia Security Initiative, Atlantic Council

Stephen Ezell, vice president, global innovation policy, Information Technology and Innovation Foundation

Eugene Gholz, associate professor of political science, University of Notre Dame

David Henderson, founder and president, Rittenhouse International Resources

Shin Oya, senior research fellow, Asia Pacific Initiative; chief representative for strategic research, Japan Bank for International Cooperation

Riley Walters, deputy director, Japan Chair, Hudson Institute

Barbara Weisel, managing director, Rock Creek Global Advisors; former assistant US trade representative for Southeast Asia and the Pacific

Eric Wenger, senior director of technology policy, global government affairs, Cisco

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